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MAKING BETTER FORAGE SEEDINGS

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Cover photograph: Les Rollins, Washington County associate agricultural agent, looks at third cutting DuPuits alfalfa on the Don Hanks farm at Salem, New York. This excellent stand is the result of adequate lime and fertilizer and good seeding practices. Good stands are essential for high yields.

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MAKING BETTER FORAGE SEEDINGS

W. L. GRIFFETH

Although high quality forage is extremely important in feeding cows properly, many farmers have difficulty producing a sufficient amount of this kind of feed.

Establishment of good stands of legumes and grasses is essential for producing profitable yields of forage. Farmers can improve stands and increase yields through the use of adequate lime and fertilizer, improved varieties and better management.

TEN STEPS TO SUCCESSFUL SEEDINGS

A good forage seeding is the result of the successful germination, growth, and survival of at least 500,000 individual legume and grass seeds on each acre. Each seed grows or dies, depending on the conditions immediately surrounding it. The following seeding practices help to provide uniformly favorable conditions for the establishment of high producing stands of forage grasses and legumes.

1. Choose the Right Seeding Mixture

Farmers in New York have a choice of many kinds and varieties of forage legumes and grasses. Excellent improved varieties of legumes and grasses are now available to fit nearly every soil, use, and management situation.

Choosing legumes and grasses with different maturity dates will provide a sequence of crops for silage, hay, or pasture and spread the first-cutting harvest over several weeks in the spring.

Detailed information on the characteristics of the different forage grasses and legumes suitable for New York are published annually in *Cornell Recommends for Field Crops* and briefly in Cornell Extension Bulletin 781, *Hay and Pasture Seedings*. The recommended seeding mixtures are discussed in respect to adaptation to soils, the use and management of the crop, and the length of stand desired.

Lime is spread on sod before corn in the summer to make the pH right for the forage seeding.

2. Use Enough Lime

Forage legumes and grasses require a rather high level of lime in the soil for good establishment and growth. Many New York soils are too acid for good forage yields. If a soil test shows that the pH is below 6.8 for alfalfa or 6.4 for birdsfoot trefoil or clovers, lime should be applied at the recommended rates. Grasses grow better when the soil pH is above 6.0

The data in table 1 show the 1959 soil pH test results from 717 hay fields on 170 farms in the acid soil areas of Otsego and Chautauqua Counties. Because of the soil acidity, few good legume stands were found in these fields.

TABLE 1. pH of 717 Hay Fields on Commercial Dairy Farms in the Acid Soil Region of Otsego and Chautauqua Counties, New York, 1959*

pH range	Number of fields	Percentage of fields
7.0 and over	2	–
6.5 – 6.9	46	7
6.0 – 6.4	218	30
5.5 – 5.9	288	40
4.5 – 5.4	164	23

*From unpublished data collected by Departments of Agronomy, Agricultural Economics, and Plant Breeding, and the Agricultural Extension Agents in the two counties, Spring, 1959. All hay fields of 5 acres and more in the 10% sample of the commercial dairy farms in Otsego and Chautauqua Counties included in the Plateau Region Farm Management Survey were sampled for complete soil test.

The data indicate that nine out of ten of these fields probably will need one to four tons of lime before they are reseeded to forage.

Liming recommendations can be found in Extension Bulletin 822, *More Lime on Your Land,* or in the current issue of *Cornell Recommends for Field Crops.*

3. Prepare a Good Seedbed

A good seedbed for the small-seeded forage legumes and grasses is firm but not pulverized. Loose soil may dry out rapidly at the surface before the seeds can germinate and put down roots into moist soil. When soil is firm and moist at planting time, the seeds germinate quickly. Water moves up by capillary action to replace the moisture that evaporates from the surface of the soil. The seeds are less likely to suffer from a lack of water when there is good contact between the seed and the soil.

If heavy soils are over-worked, the crumb structures may be destroyed. Crusting then may occur when the soil dries out after the first rain and the young plants cannot break through the crust.

Firming the soil with a corrugated packer or roller before and after the forage seeds are planted is a good practice on many soils. Packing is particularly important for summer seedings.

A fine, firm seedbed improves the chances of a successful forage seeding.

4. Use a Good Seeding Method

A good seeding method is one that will give the seed the best possible chance to germinate and grow. The seeds of forage legumes and grasses are so small that it is physically impossible for them to come up if they are covered too deeply. The ideal for most conditions is to place the seed $\frac{1}{4}$ to $\frac{1}{2}$ inch deep in a well-prepared, moist seeedbed. On sandy soils the seeding should be about $\frac{1}{2}$ to $\frac{3}{4}$ inch deep, since the surface of these soils may dry out rapidly.

Table 3 shows the results of a Cornell experiment comparing methods of seeding. In this experiment the alfalfa seeding was made in the spring without a companion crop. In half the plots the alfalfa seed was drilled one-fourth inch deep and covered with a press wheel. In the other half the same amount of seed was broadcast and then covered by one trip with a corrugated packer. The effect of fertilizer was determined by comparing drilled and broadcast fertilized plots with plots receiving no fertilizer.

The data in table 3 illustrate two important points: yields are affected by fertilizer and fertilizer placement; and by the depth of seeding and seed placement.

The results clearly illustrate the value of fertilizer in seeding establishment. The fertilized alfalfa averaged 3.11 tons in the first hay year while the unfertilized alafalfa averaged 1.45 tons per acre.

The alfalfa with drilled fertilizer produced nearly 700 pounds more hay per acre in the first hay year than alfalfa with broadcast fertilizing Research results at a number of experiment stations point out that phosphorus is particularly important for seeding establishment. In many experiments on soils low in available phosphorus, banded (drilled) phosphorus has been superior to broadcast phosphorus.

The seed drilled one-fourth inch deep came up in a little more than a week. Four weeks were needed for the surface-seeded alfalfa to come up. These results

TABLE 2. Effects of Depth of Seeding on Stand and Yield*

Depth of Seeding	Alfalfa		Birdsfoot Trefoil	
	Stand	Yield	Stand	Yield
Inches	Percent	Percent	Percent	Percent
0	73	75	65	69
$\frac{1}{4}$	100	100	100	100
$\frac{1}{2}$	96	98	87	93
$\frac{3}{4}$	65	75	41	70
1	46	68	36	61
$1\frac{1}{2}$	37	56	27	42
2	23	40	14	29

*Unpublished data from H. A. MacDonald, Cornell University, Ithaca, N. Y.

TABLE 3. Effect of Fertilizer and Seed Placement on Alfalfa Seeded Alone*

Fertilizer**	Seed	Days to come-up	1st year hay yield
		days	Tons/acre
Drilled, 1½"	Drilled, ¼"	8	3.42
Broadcast	Drilled, ¼"	9	3.27
Drilled, 1½"	Broadcast	27	3.15
Broadcast		27	2.63
None	Drilled, ¼"	9	1.67
None	Broadcast	27	1.23

*From unpublished data, H. A. MacDonald, Cornell University.
**200 pounds of 0-20-20 drilled 1½ inches deep when alfalfa was planted or broadcast before last harrowing before seeding.

are for 1954 when the surface soil was rather dry after planting. The drilled alfalfa produced 900 pounds more hay per acre in the first year than the broadcast alfalfa.

Band seeding with a grain drill or planting with a packer-seeder are two ways to get shallow coverage of forage seeds. In addition, a properly adjusted band seeder places the forage seeds where the roots of the young seedling can get quickly to the band of fertilizer.

This grain drill is equipped for band seeding of legumes. A good seeding method places the seed one-quarter to one-half inch deep in moist soil.

5. Use Enough Fertilizer

High yields of hay or pasture remove more phosphorus and potash than most New York soils can supply naturally. A four-ton crop of good legume and grass hay will contain 40 to 50 pounds of phosphate and 160 to 200 pounds of potash.

All New York soils are naturally low in phosphorus. Some fields are now medium to high in phosphorus because of the application of liberal amounts of phosphorus for several years. Soils high in phosphorus require no added phosphorus for good yields of established forage crops. However, phosphorus applied at planting time is usually beneficial in starting the young seedlings of legume and grass as shown in table 3.

Soils in New York differ greatly in their natural ability to supply potash year after year. Soils high in potassium-supplying power can usually produce 2 to 3 tons of hay per acre per year without additional potash from fertilizer or manure. Low potash-supplying soils produce less than 1 ton of forage without additional potash. Fertilizer is necessary for good establishment and high yields on practically every soil.

The grade and amount of fertilizer to use depend on the type of soil (potassium-supplying power); the fertility status of the soil as indicated by past crop history and complete soil test results; and the expected yield level as influenced by the kind of crop, management practices, type of soil, and the climatic conditions of the area.

General fertilizer recommendations for forage crops are published annually in Cornell Extension Bulletin 780, *Fertilizers for Field Crops,* and in *Cornell Recommends for Field Crops.* Complete soil test results help to determine more accurately the grade and amount of fertilizer to use.

Fertilizers for forage establishment usually supply considerable phosphorus. Typical recommendations call for 60 to 80 pounds of phosphorus for establishment. As discussed in the seeding method section, phosphorus is very important for rapid growth of young forage seedlings. Band seeding places phosphorus near the seeds.

Potassium requirements depend largely on the potassium-supplying power of the soil and the amount of available potash as indicated by soil tests. Typical recommendations call for from 0 to 80 pounds of potassium at seeding. Potash is necessary for high yields, winter survival, and long-lived stands.

Nitrogen is usually not used in fertilizing forage legume seedings made without a companion crop. If grasses are seeded without a legume, nitrogen will be helpful in establishment and is necessary for good yields.

When forages are seeded with a companion crop such as oats, the past lodging history is the best guide for determining the amount of nitrogen to use. If

lodging of the grain is likely to occur, no nitrogen should be used. When some lodging occurs, present recommendations call for 20 pounds of nitrogen per acre.

6. Always Inoculate

All forage legumes should be inoculated with the right strain of nitrogen-fixing bacteria before planting. Legumes do not produce nitrogen if the rhizobium bacteria are not present and actually living on the roots. Some wild strains of bacteria living in the soil are poor nitrogen fixers. They form small nodules but produce little nitrogen. Careful inoculation with fresh culture improves the chances of strong nodulation and liberal nitrogen fixation.

Inoculate seed just before planting. Reinoculate if seeding is delayed more than 24 hours.

A heavy stand of volunteer oats in September from seed thrown over by the combine.

7. Manage Companion Crops Properly

Small grain crops compete with young legume and grass seedlings for light, moisture, and nutrients. The grain crop may lodge, causing damage to the new seeding. Volunteer grain, after combining, often prevents good seeding establishment. The illustration above shows a heavy stand of oats in the fall after combining.

The illustration on page 10 shows the loss of forage stand in the spring following a heavy stand of volunteer oats. Careful combine adjustment can reduce the amount of grain thrown over and there will be less volunteer oats.

Pasturing or harvesting the small grain crop for hay or silage will reduce the competition to the forage seeding. When oats are used for hay or silage, they should be cut at about the milk stage. Farmers report that the hay conditioner hastens the drying of oat hay.

Oats are ready to graze when they are six to eight inches tall. The field should be grazed quickly without damaging the forage seeding and then grazed again each time the oats grow to a height of six to eight inches. Some farmers delay grazing until the oats are headed. This often results in the cattle trampling the oats, with considerable waste of oat forage and damage to the forage seeding.

The following spring: the heavy stand of oats killed the forage seedlings.

8. Control Weeds

Weeds compete with forage seedlings for moisture, light, and nutrients. A light seeding of oats or other spring grain will often help keep down the weeds.

Where weeds are a problem, spraying with a weed control chemical will decrease the weed competition. When weed control chemicals are applied at the recommended rate and growth stage of the weeds and legume seedlings, the weeds are killed with little damage to the legumes. See the current revision of Cornell Extension Bulletin *Weed Control in Field Crops,* or *Cornell Recommends for Field Crops* for exact recommendations.

Where herbicides are used for weed control, the oats should not be grazed for at least four weeks. If oats are to be grazed when six to eight inches tall, herbicides should not be used for controlling weeds.

If annual weeds become serious, the weeds and forage growth should be mowed as low as possible about the middle of August but no later than September 1. This will set back the weeds because most of the buds for regrowth on annual weeds are above ground along the stem. The buds of most legumes (except sweet clover) and grasses are near the ground and are not removed by close mowing.

9. Control Insects

The potato leafhopper causes considerable damage to new seedings of legumes. The leafhopper stunts the growth and causes yellowing of the plants. According to Cornell entomologists, farmers should spray new seedings as soon as possible after combining or harvesting small grain for silage. See the current issue of *Cornell Recommends for Field Crops* for spray recommendations.

10. Observe Careful Fall Management

To reduce the danger of injury and winterkilling of the forage plants, grazing or cutting the new seeding for forage or weed control should be complete four to six weeks before the average date of the first killing frost.

There is real danger of damaging new seedings of forage legumes by removing the top growth in early fall because legumes live through the winter and make their first six to twelve inches of spring growth on food stored in their roots the previous fall. This reserve is built up at certain times during the growing season, but not continuously throughout spring, summer, and fall.

When growth starts and the size and number of leaves increases, the plant manufactures more and more of the food needed for growth and soon has a surplus of food. Each time the legume crop is cut or pastured, the plant goes

Heaved alfalfa plants. Careful fall management improves the ability of legumes to resist winterkilling.

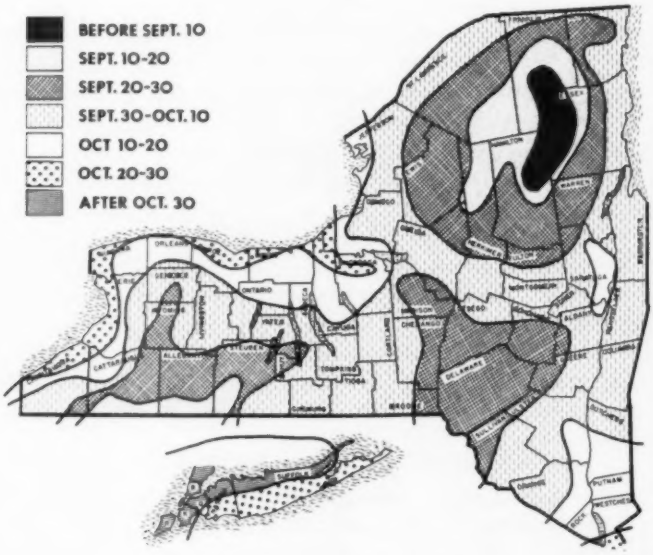
through the following cycle: new growth draws stored food from the roots; food is manufactured and used for rapid growth; and surplus food is stored in the roots.

Therefore, the time of fall cutting or grazing is important. If the plant has only a short growing period before frost and cold weather, its root reserves of stored food will be used in making new top growth instead of being held over for starting growth the following spring. Legumes low in food reserves are susceptible to winter killing.

Average date of first killing frost. The average date of the first killing frost is used to help predict when growth may be expected to cease. The first killing frost is seldom more than ten days before or after the average date shown on the map.

New seedings. Allow from four to six weeks before the average date of the first killing frost for legumes to build up reserve food supply. When new seedings of red clover or alfalfa make very rank growth, careful grazing in late fall that leaves six inches of growth is a good practice.

Established stands. Do not cut or graze long-lived stands of alfalfa during the four weeks before the average frost date. Because of their lower growth



Average dates of the first killing frost in the fall.

habit, Empire birdsfoot trefoil and ladino clover can survive fall grazing better than can the upright growing legumes, but they must be allowed some growth before frost.

Cutting or pasturing after frost. Unless a field has a very heavy growth, it is usually better to leave the forage without grazing or mowing after frost. The crop residue after frost may give some protection from winter injury to legume and grass plants.

Heavy fall growth may smother the plants and shelter field mice that may damage the forage plants severely.

If the field has been grazed very closely, a light application of strawy manure may help to protect the stand over winter. The use of manure, however, may stimulate the grasses which in turn may suppress the legume seedlings. There is also danger of introducing weed seeds in the manure.

SEEDING BIRDSFOOT TREFOIL

Birdsfoot trefoil seedlings are not as vigorous and fast-growing as alfalfa or clover. Because of this, careful control of the companion crop and/or weeds to keep competition at a low level is necessary for establishing good stands.

Birdsfoot trefoil is more difficult to inoculate successfully than is alfalfa or the clovers. The use of extra inoculant along with some type of sticker such as syrup, milk and cornstarch, or a commercial coating material may increase the chances of successful inoculation.

Birdsfoot trefoil is seeded best in early spring. Summer and fall seedings of birdsfoot trefoil are seldom satisfactory.

Timothy is usually the best grass to plant with birdsfoot trefoil. Bromegrass and orchardgrass are often too competitive for birdsfoot trefoil.

SEEDING BROMEGRASS

The seeds of bromegrass are large, light, and fluffy. This makes seeding difficult with many kinds of equipment. Seeders with specially designed grass seed boxes work well.

Many farmers sow bromegrass successfully by mixing the seed with oats and drilling as shallowly as possible. Frequent mixing of the seed in the drill box may be necessary to prevent separation of the bromegrass and oats.

SEEDING IN WINTER GRAINS

Most of the legume and grass seedings in winter grains are broadcast in early spring before the wheat or barley makes much growth. Seeding while the soil surface is honey-combed from frost action and before rains settle the soil usually gives good coverage.

Packing the soil before and after seeding improves chances for successful August seedings.

If the seeding is delayed, the grain may be growing so rapidly that the forage seedlings cannot compete for light. The soil surface is likely to be firm and may be dry. This may account for poor germination and growth of the forage seedlings. Timothy and bromegrass may be seeded in the fall when the small grain is planted.

SUMMER SEEDINGS

When soil moisture is favorable and a firm seedbed can be prepared, alfalfa can be sown in mid-August in some areas of the state. August seedings, in dry years, and September seedings often fail because the forage seedlings do not make enough growth to survive the winter.

When seeding in August after wheat harvest, discing the seedbed is usually better than plowing. Plowing usually leaves a loose seedbed which is difficult to prepare for seeding. Packing the soil before and after planting is important for successful summer seedings.

BAND SEED FOR BETTER FORAGE SEEDINGS

Band seeding is placing the forage legume and grass seeds in rows over bands of fertilizer drilled one and one-half to two inches below the surface. The forage seeds are dropped on the soil surface nine to twelve inches behind the drill discs or boots.

Advantages of Band Seeding

Band seeding results in better germination and emergence because of shallow coverage. One-quarter to one-half inch placement is ideal for alfalfa, the clovers, birdsfoot trefoil, and timothy.

Young legume seedlings have a high requirement for fertilizer, especially phosphorus. Band seeding places the seeds near the fertilizer. Plants get fertilizer quickly and start more rapidly.

Banded seed is in better contact with soil moisture than surface seeding.

Less seed is needed for a satisfactory stand if seed is banded on a good seedbed.

Equipment for Band Seeding

Low-cost band seeding attachment kits are available for most types of grain drills with front-mounted grass seed attachments. The kits include tubes about 40 inches long to carry the forage seed from the front-mounted seed box to a point nine to twelve inches behind each disc or hoe.

Most makes of grain drills can be purchased with rear-mounted grass seed boxes with short spouts or hoses to place the forage seeds in rows over the fertilizer band.

You can make your own band seeding attachment. Old garden hose works fairly well but may be too stiff or brittle. You will need to make brackets of strap metal or design some other method that will hold each tube in the correct position.

Important Points to Remember for Successful Band Seeding

The band seeding hoses should be cut so that the seed is dropped two or three inches above the ground when the drill discs are in the soil. Longer hose may catch soil and become plugged when backing the drill.

Adjust each hose so that seed is dropped nine to twelve inches behind the disc.

Prepare a fine firm seedbed. If the seedbed is too cloddy, the small forage seeds will be planted too deep.

Band seeding, plus rolling with a corrugated packer before and after drilling, increases the chances for successful seedings if the soil is not too wet to roll.

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